

# EMERGENCY MANAGEMENT BRANCH

## Hazard, Risk and Vulnerabilities Assessment Report



REGIONAL MUNICIPALITY  
OF **WOOD BUFFALO**

[www.woodbuffalo.ab.ca](http://www.woodbuffalo.ab.ca)

## **PREFACE**

**Major emergencies and disasters can occur anywhere, anytime. Some are primarily seasonal while others can occur swiftly and without warning. Having an awareness of the particular natural and technological hazards and their potential affects will assist the Regional Municipality of Wood Buffalo to implement effective mitigation, preparedness, response and recovery plans and programs.**

**- MAY 2009**

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## INTRODUCTION

A Hazard, Risk and Vulnerabilities Assessment (HRVA) is a process designed to apply risk management principles to emergency preparedness. Within this report the following three underlying elements to the risk management process were evaluated: frequency, consequences and perspective. The frequency or probability is how likely is it that the hazard under consideration is to occur in the future. The consequence or impact is what effects the various hazards will potentially have on the Regional Municipality of Wood Buffalo. The perspective refers to the different values different people will assign to various risks.

In order to conduct this HRVA, the Emergency Management Department brought together a group of employees from various Regional Municipality of Wood Buffalo departments. Representatives from the Wood Buffalo RCMP Detachment and the local Government of Alberta Transportation office also participated. The group was led through a workshop and facilitation process on HRVA, followed by the creation of a List of Risks that were evaluated in this document. Through this process they completed the first four of six steps necessary to create an HRVA:

- Step 1 – Getting Started
- Step 2 – Preliminary Analysis
- Step 3 – Risk Estimation
- Step 4 – Risk Evaluation
- Step 5 – Risk Controls and Finalization
- Step 6 – Implementation and Monitoring

The Emergency Management Department is currently in Step 6 we have implemented the HRVA report and have begun monitoring the region. The HRVA will be reviewed, updated, and revised as required, each year with a thorough review to be completed in year 5. In years 6 – 9, the plan will continue to be reviewed and updated, as required. In year 10, the Emergency Management Department will complete the entire HRVA process again and update the Municipal Emergency Plan with any new or additional hazards identified.

The Regional Municipality of Wood Buffalo **Hazard, Risk and Vulnerabilities Assessment** is a historical review of hazards within the urban and rural geographic regions. Specific hazards may cause secondary effects; however the prime vulnerabilities will be the focus of this report, using secondary effects as examples. For ease of reference, particular hazards are profiled in alphabetical order.

On the following page is the Risk Evaluation that was completed by this group:

**RISK EVALUATION**  
**REGIONAL MUNICIPALITY OF WOOD BUFFALO**

<b>EVENT\CONSEQUENCES</b>	<b>Extreme</b>					
	<b>Major</b>	<ul style="list-style-type: none"> <li>➤ Dang. Goods Spill</li> <li>➤ Industrial Accident</li> <li>➤ Public Health Emergency</li> </ul>	<ul style="list-style-type: none"> <li>➤ Flooding</li> <li>➤ Wildfires</li> </ul>			
	<b>Moderate</b>	<ul style="list-style-type: none"> <li>➤ Large Rural Structure Fire</li> <li>➤ Loss of Natural Gas</li> <li>➤ Chlorine Gas Leak</li> </ul>	<ul style="list-style-type: none"> <li>➤ Winter Road Failure</li> </ul>			
	<b>Low</b>	<ul style="list-style-type: none"> <li>➤ Chlorine Gas Leak</li> <li>➤ Loss of Building</li> </ul>	<ul style="list-style-type: none"> <li>➤ Water Supply</li> <li>➤ Power Outage</li> </ul>		<ul style="list-style-type: none"> <li>➤ Severe Storms</li> </ul>	
	<b>Very Low</b>		<ul style="list-style-type: none"> <li>➤ Comm. Loss</li> </ul>			
		<b>Very Unlikely to Happen</b>	<b>Occasional Occurrence</b>	<b>Moderately Frequent</b>	<b>Occurs Often</b>	<b>Virtually Certain to Occur</b>
	<b>FREQUENCY</b>					

- Extreme risk:** Immediate controls required
- High risk:** High priority control measures
- Moderate risk:** Some controls required to reduce risks to lower levels
- Low risk:** controls not likely required
- Negligible risk:** No further action required

## OVERVIEW OF EMERGENCY MANAGEMENT IN THE MUNICIPALITY

All municipalities in Alberta are required by the Province of Alberta *Emergency Management Act, R.S.A. 2000, c. E-68* to implement plans and programs to assist in mitigating the effects of, preparing for, responding to, and recovering from major emergencies or disasters. The overall objective of the emergency planning program in the Regional Municipality of Wood Buffalo is to foster timely and effective preparedness to:

- Preserve the life and safety of individuals;
- Minimize damage to public and private property and municipal infrastructure;
- Preserve the economic viability of the municipality; and
- Expedite the restoration of essential services and the rapid and complete recovery from the effects of any major emergency or disaster.

## OVERVIEW OF THE MUNICIPALITY

Stretching from north central Alberta to the borders of Saskatchewan and the Northwest Territories, the Regional Municipality of Wood Buffalo is among North America's largest municipalities. It was established April 1, 1995, through the amalgamation of the City of Fort McMurray and Improvement District No. 143. It is 68,425.23 square kilometers (6,842,523.44 hectares) in area, of which a substantial portion is rural. The elevation of the municipality varies from 184.971 m to 836.859 m. Topography is rugged as the municipality is surrounded by Boreal Forest, with the exception of a scattered Canadian Shield that starts at the Saskatchewan border, moving north and east. Remnants of the Canadian Shield can be seen in and around Fort Chipewyan. The municipality has one of the fastest growing industrial communities in Canada.

The municipality is comprised of one urban service area – Fort McMurray – and 10 small rural communities: Anzac, Conklin, Draper, Fort Chipewyan, Fort Fitzgerald, Fort MacKay, Gregoire Lake, Janvier/Chard, Mariana Lake and Sapræ Creek.

The Regional Municipality of Wood Buffalo is rich in cultural diversity. Its citizens enjoy access to economic and educational opportunities, health services, and an abundance of recreational and cultural activities.

## Demographics

The municipality has a population of 108,615 (source: Municipal Population and Employment Projection, Model January 12, 2010). The population fluctuates within the region each day as transient workers from other parts of Alberta and Canada fly or drive in and out.

A comparison of 2006 Census data from the Regional Municipality of Wood Buffalo suggests that Fort Chipewyan has a higher percentage of both seniors and children under the age of twenty and a lower percentage of adults ages 20-64 when compared Regional Municipality of Wood Buffalo. In 2006, an estimated:

- 9.0% of Fort Chipewyan residents were seniors (versus 1.8% in the Regional Municipality of Wood Buffalo);
- 51.3% of Fort Chipewyan residents were adults ( versus 7% in the Regional Municipality of Wood Buffalo); and
- 33.9% of Fort Chipewyan residents were children (versus 26.4% in the Regional Municipality of Wood Buffalo).

In terms of senior living in Fort Chipewyan, 2005 income data shows that:

- Seniors ages 65 and over tended to earn between \$10, 000 and \$30, 000;
- Single seniors tended to earn between \$10, 000 and \$20, 000; and
- Senior couples tended to earn between \$15, 000 and \$30, 000.

The major industry in the Regional Municipality of Wood Buffalo is Oil and Gas. This industry, however, is supported by municipal government, provincial government and other local industry. The top 20 employers in the region are as

follows (source: Municipal Population and Employment Projection, Model January 12, 2010):

Organization Name	Size Range	Total Employees
Syncrude Canada Ltd	5,000 to 9,999	5500
Shell	1,000 to 4,999	2758
Suncor Energy Inc.	1,000 to 4,999	2272
Nexen	1,000 to 4,999	1305
Canadian Natural Resources	1,000 to 4,999	1280
Regional Municipality of Wood Buffalo	1,000 to 4,999	1128
Diversified Transportation Ltd	500 to 999	929
North American Construction Group	500 to 999	595
Cow Harbour	500 to 999	550
Northern Lights Regional Hospital	500 to 999	435
Tri-Vax Enterprises Ltd.	500 to 999	
L Robert	250 to 499	412
Jacobs Catalytic Suncor	500 to 999	300
Clearwater Welding and Fabrication LP	250 to 499	258
Aluma Systems Canada Inc	100 to 249	250
CBS Construction	250 to 499	250
Finning Canada	250 to 499	220
Mikisew Energy Services Group	100 to 249	212
Acuren Material Engineering Testing	100 to 249	200
Cross Oilsands Contracting Ltd	100 to 249	171

## Transportation

The Regional Municipality of Wood Buffalo offers transit service to its urban and rural communities.

The **Fort McMurray Public Transit System** provides efficient bus service with fixed routes and schedules. Offering 11 regular routes and service 7 days a week, it carries 1,135, 719 riders in 2010 and links all of Fort McMurray's subdivisions through direct or feeder connections. Although weekend service remains reduced, service is being extended on select stat holidays (Family Day, May long weekend, Canada Day, Heritage Day and Labour Day) in 2012.

SMART Service (Special Mobility Required Assistance Transit) now operates 8 units, 7 days a week. In 2010 they transported 16, 301 passengers. The majority are pre-booked rides, but effective September 2010 a fixed route (Community Bus) was established to allow this clientele flexibility and a last minute option.

The **Regional Municipality of Wood Buffalo Rural Public Transit System** provides rural bus service from Janvier, Conklin and Anzac to Fort McMurray and back to these rural areas on Tuesday, Friday and Sunday and service to Sapræe Creek that operates every Saturday. This rural transit service see approximately 2, 533 passengers annually.

**CN Rail** is the only railway carrier in the region and the rail line ends south of Sapræe Creek at Lynton Siding. The majority of goods that it currently transports include steel and timber, and some dangerous goods. CN Rail plans to upgrade its rail line in the near future and has proposed to transport crude oil products under a concept they have developed, known as "*PipelineOnRail.*"

**There are three major roadways** within the municipality: Highways 63, 69 and secondary Highway 881. A winter road is also created each year to supply land access from the Urban Service Area of Fort McMurray north to Fort Chipewyan,

continuing up through Wood Buffalo National Park to Fort Fitzgerald and Fort Smith, Northwest Territories.

**The Fort McMurray Regional Airport (CYMM)** is located 6 kilometers southeast of the Urban Service Area of Fort McMurray and occupies a land area of approximately 512 hectares (1,266 acres). The airport is designated as a regional airport under the National Airports Policy (NAP). The airport is certified as a local commercial, Sub-Class VII and can accommodate aircrafts, up to and including a Boeing 767.

The airport operates with a sole runway that is 2,286 meters (7,500 feet). An air terminal building, 2,950 square meters (31,753.8 square feet) was built in 1984, and includes maintenance facilities, lighting structures and collateral commercial facilities. The airport serves as a point of call for air carriers offering scheduled passenger service and services for both private and commercial helicopter and fixed-wing aircraft operators located onsite.

Annual passenger movements have increased from 223,000 in 2004 to 695,000 flights in 2008. Commercial aircraft movement has increased from 45,000 in 2004 to 71,000 in 2008. The airport is classified as a Category 6 Airport and falls under Canadian Aviation Regulations (CARs) 303 subpart 3. As of June 30, 2008, CYMM was required to provide on-site airside emergency services and, more specifically, to be able to provide 2 emergency vehicles to the middle of the runway within 3 minutes of an alarm during 90% of operating hours. The airport fire hall, vehicles and equipment meet all Transport Canada standards.

**The Fort Chipewyan Airport (CYPY)** - served by a regional airport that has 2 major airlines as well as charter services, the community is heavily reliant on air transportation. It is an all-weather facility, servicing 1,800 flights annually with a maximum runway length of 1,524 meters (5,000 feet). It is located 8 kilometers north of Fort Chipewyan. The airport provides the only means of transporting critically ill patients. It is operational 24 hours per day, 7 days a week and is capable of supporting Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations.

The only other transportation links for the community is the winter road from late December to mid March each year, and by private boat from mid June to September each year. Sound knowledge of the rivers and Lake Athabasca is a must for those travelling to and from the community by boat.

**Three major bridges** traverse the Athabasca River on Highway 63 in the middle of the Urban Service Area of Fort McMurray. The Grant MacEwan Bridge provides traffic flow south bound into Fort McMurray, while the Steinhauer Bridge allows traffic flow north bound out of Fort McMurray. Both of these bridges are currently closed for renovations. The Athabasca Bridge is a new 5 lane bridge that allows traffic flow north and south bound Fort McMurray.

There is a fourth bridge crossing – Peter Lougheed Bridge, (also referred to by some users as *“The Bridge to Nowhere”*), located just north of Fort MacKay, Alberta. There are also a number of secondary bridges that span various rivers and creeks within the municipality.

### **Primary Dangerous Goods Routes**

Based on the 2003 Municipal Dangerous Goods Incident Assessment Report, there are over 220 different carriers that operate within the municipality. This does not include those that are based out of other locations in the Province and the rest of Canada. The same study provided a conservative estimate that 150 truckloads travel the roadways daily within the municipality, with the majority of travel occurring between 7:00 AM and 7:00 PM. That would equate to one truck every five minutes. The authors tempered their assessment with the comment that only one truck every two hours would be carrying extremely hazardous chemicals. Highway 63 between Fort MacKay and Highway 69 provides the greatest risk with volume of traffic and concentration of people.

## Schools, Hospitals and Nursing Homes

Alberta Health Services – Fort McMurray, (formerly known as Northern Lights Health Region), provides a broad spectrum of community-based and acute healthcare services to a growing population with increasingly diverse health needs. The Northern Lights Regional Hospital is fully equipped with 24 hour emergency care, an intensive care unit, full surgical services, a radiology unit and a medical laboratory. It offers a total of 123 beds, ranging from acute care, continuing care to respite beds. There is a variety of health support programs provided through the Health Centre. Numerous non-profit health and crisis agencies also operate within the Municipality.

Similarly, the Nunee Health Board Society in Fort Chipewyan is the lead public health agency for the Athabasca Chipewyan and Mikisew Cree First Nations communities and the Hamlet of Fort Chipewyan. The Nunee Health Board Society provides a nursing station, wellness centre, home care, public health, and tele-health services to residents of those communities.

## HISTORICAL INCIDENTS

From a historical perspective, the following table lists some of the significant incidents that have occurred within the region (as seen in the chart on the following page):

HISTORICAL INCIDENTS REGIONAL MUNICIPALITY OF WOOD BUFFALO	
DATE	EVENT
1697	Inter-Tribal Wars – the Cree drove the Chipewyan north and east of the Athabasca District using guns obtained from fur traders.
1784	Smallpox killed 90% of the Chipewyan First Nation.
1881	Smallpox ravished the Chipewyan First Nation.
1920 - 21	Spanish Flu in Fort Chipewyan killed many people. Mass graves were dug at a location where the Northern Store

<b>HISTORICAL INCIDENTS</b> <b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	now stands.
1929	A commercial airway plane A-1-A crash-landed at Fort Chipewyan, killing four boys.
August 26, 1956	A Northern transportation tugboat sank during a storm in 135 feet of water on Lake Athabasca. Eight crew members drowned and the boat was salvaged.
September 1966	A private jet aircraft carrying three Americans crashed 8 kilometers from the Embarras airstrip; the aircraft was found two years later.
July 1, 1967	Two boats collided near Potato Island, resulting in the drowning deaths of two persons.
1973	The Bishop Piche School Bus went through the ice on Rocher River. The driver and students escaped without injury.
1973	A highway snowplow also went through the ice on the Rocher River; the vehicle driver and a passenger narrowly escaped.
January 1977	The Fort Chipewyan community hall burned down.
1978	A Russian satellite crashed near Snowdrift, (Lutsel K'e) NWT. Radioactive fragments were found in Fort Chipewyan.
October 15, 1981	Barges were trapped in ice. A Canadian Armed Forces Hercules aircraft flew in gas.
1981	An oil spill occurring near Fort McMurray is believed to have affected area water systems and fish as far north as Fort Chipewyan.
1981	A skidoo went through ice near Fort Chipewyan, resulting in the deaths of two people.
May 29, 1995	The Mariana Lake Wildfire engulfed 132,679 hectares. The resulting in a closure of highway 63 cut off access to Fort

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	McMurray and other northern communities, limiting supplies and other resources for several days.
April 20, 1997	Ice jams at the confluence of the Athabasca and Clearwater Rivers resulted in flooding within the Lower Town site of Fort McMurray, displacing both residents and businesses.
May 17, 2002	The House River Wildfire, ignited by lightning, engulfed 238,867 hectares, resulting in the residents of Conklin being temporarily displaced.
June 9, 2002	The Meyers Lake Wildfire engulfed 127, 453 hectares.
June 18, 2003	The Fort MacKay Wildfire engulfed 477 hectares.
July 17, 2004	The Cree Lake Wildfire engulfed 34,389 hectares.
June 16, 2006	The Louise River Wildfire engulfed 1,745 hectares.
June 20, 2006	The Embarras Wildfire engulfed 3,413 hectares.
June 29, 2006	The Little Horse Creek Wildfire engulfed 7,400 hectares.
April 17, 2007	A structure fire in the Edgewater Court Apartment Building resulted in the evacuation of 300 residents. The Municipality's EOC was activated to meet the needs of area residents.
April 24, 2007	A structural collapse of a large oil tank under construction occurred on the CNRL Horizon Project site. Two workers were killed and left four injured.
June 1, 2007	The McKay River Wildfire engulfed 16,126 hectares.
July 17, 2007	The Old Fort Wildfire engulfed 63,000 hectares.
July 22, 2007	A helicopter carrying 4 forestry workers and 1 crew member crashed in a remote rural location within the Municipality. One person was fatally injured.
August 2, 2007	Large hail storm impacted residents in the Prairie Creek residential sub/division on the south side of the Urban Service Area, damaging homes, vehicles and landscape.

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
November 13, 2007	A single vehicle rollover involving a tanker carrying dangerous goods (Ammonium Hydroxide) on Hwy. 63, south of Hwy. 69 intersection, resulting in a temporary closure of north and south lanes of Hwy. 63.
February 22, 2008	A motor vehicle collision involving a semi-tractor trailer unit attempting to pass a wide load (coker) on Hwy. 63 at the House River Bridge. This incident resulted in a closure of Hwy. 63, with all traffic re-routed to Hwy. 881 as crews worked to re-attach the coker to its trailer.
March 27, 2008	A work crew clipped a four inch natural gas line while excavating to repair a water main break. Manning Avenue between Hospital and Queen St was closed to traffic, pedestrians and businesses
April 22, 2008	A three day snow storm with a large accumulation of snow on roadways resulted in an activation of the Municipality's EOC to develop contingency plans for the delivery of vital services in and around the Urban Service Area of Fort McMurray.
June 26, 2008	A report in the Abasand Heights residential sub/division in which 3 persons were shot led to police closing the only access road, Abasand Drive, to contain the scene. Father Beauregard School initiated their lockdown procedures to safeguard staff and students. The Municipality's EOC was activated to meet the needs of area residents and commuters who were stranded.
July 24, 2008	Greenpeace activists waged a protest after 500 ducks were found dead in a tailings pond on the Aurora Mine Site operated by Syncrude Canada Ltd. (April 2008).
January 3, 2009	Approximately 4,000 barrels of oil leaked from a pipe at the Enbridge Pipelines Inc. Cheecham Terminal Tank

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	Farm, situated approximately 20 kilometers south of Anzac, Alberta. Most of the oil spill was held within containment berms that ring the tank farm. A small amount of oil sprayed into the air, drifting onto nearby snow and trees.
February 19, 2009	A blizzard affected an area from Mariana Lake north to Fort McMurray. Several motorists were stranded on Hwy. 63 while crews worked to clear the roads.
June 1, 2009	An explosion at the Mildred Lake Plant Site operated by Syncrude Canada Ltd. injured four persons, sending two to hospital.
June 14, 2009	The Stoney Mountain Complex Wildfire, the result of lightning strikes, generated smoke and reduced visibility in many areas, including portions of Highway 63 which was temporarily closed. Gregoire Lake was also closed as water bombers used it as a water source.
September 15, 2009	25 Greenpeace activists entered the Muskeg River Mine Site operated by Shell Canada 82 kilometres north of Fort McMurray, and chained themselves to heavy equipment. Activists remained there 2 days, supplying live video footage to their website and unfurling banners. Activists left the property without charges being laid.
September 30, 2009	23 Greenpeace activists trespassed onto a mine site operated by Suncor Energy Ltd., traveling by boat on the Athabasca River. This event ended after police arrested 21 of the activists, many of whom were from European countries.
January 22, 2010	A tanker carrying dangerous goods (Sulfur) while travelling south on Hwy. 63 approximately 4 kilometers north of Fort McMurray capsized, resulting in a

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	temporary closure of both the north and south bound lanes on Hwy 63.
April 9, 2010	A tanker carrying 20,000 litres of dangerous goods (diesel) on Hwy 63 North rolled over spilling fuel onto the roadway and surrounding area. It is unknown how much spill but one lane was closed down to accommodate the cleanup of the spill.
April 9-11, 2010	A three day snow storm in the Regional Municipality of Wood Buffalo blanketed the region with 30 cm of snow in 3 days. Several motorists were stranded on Hwy 63 and 881 and on local residential streets while road crews worked to clear the roads. Power outages occurred within the urban centre of Fort McMurray leaving residents without power for a couple of hours as repair crews navigated the snowy roads. The local landfill site was closed due to impassable roads.
April 20, 2010	Regional Emergency Services responded to a dangerous goods incident at the Fort McMurray Hospital. The incident was the result of a small dangerous goods spill in the Lab. The mitigation of the spill was completed in about an hour. The hospital followed their Emergency Response Plan and evacuated the lab and nearby Records Department.
June 10, 2010	A fire broke out in the Mildred Lake Facility Plant 7-3 Diluents Recovery Unit (DRU) operated by Syncrude Canada Ltd. that took just over an hour to extinguish. Of the 5 workers transported to hospital with burn injuries, 2 were treated and released, while 3 were air lifted to an Edmonton hospital.
June 27, 2010	A series of lightning strikes resulted in wildfires on the

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	northern edge of the municipality and Wood Buffalo National Park. A wildfire in northern Saskatchewan that burned over 300,000 hectares brought smoke into the region, affecting and causing concern within the communities of Fort Fitzgerald and nearby Fort Smith, NT.
July 9, 2010	An unplanned release of hydrogen sulphide (H <sub>2</sub> S) and ammonia from a C-4 overhead drum occurred at the Mildred Lake plant at Syncrude when a weld failed on this drum. Workers were immediately evacuated and two workers were taken to hospital with minor injuries.
July 10, 2010	A well blowout occurred in a remote location near Conklin. At 2350 hrs Devon Canada stopped the blowout using increased water pump rates down the injection well and production well. Containment and absorbent booms were deployed in Monday Creek containing the hydrocarbon sheen.
July 15, 2010	Poor air quality advisory was issued due to forest fires in Northern Alberta and Saskatchewan. Alberta Health Services advised residents of Fort MacKay, Fort McMurray, and Fort Chipewyan with respiratory health problems to take care and stay indoors.
July 9, 2010	An unplanned release of hydrogen sulphide (H <sub>2</sub> S) and ammonia from a C-4 overhead drum due to the failure of a weld occurred at the Mildred Lake Facility Plant operated by Syncrude Canada Ltd. Workers were immediately evacuated, two of whom sustained minor injuries and were taken to hospital for treatment.
July 10, 2010	A well blowout occurred in a remote location near Conklin. Devon Canada stopped the blowout using

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	increased water pump rates down the injection well and production well. Containment and absorbent booms were deployed on the Monday Creek containing the hydrocarbon sheen.
July 19, 2010	A contractor completing road repairs on Franklin Avenue in the Lower Town Site struck a 4 inch gas line, resulting in the evacuation of 4 businesses for a short period of time. The gas line was capped quickly and employees were allowed to return to their businesses.
August 19, 2010	A Cessna 206 aircraft owned and operated by McMurray Aviation with 1 pilot and 4 passengers onboard experienced a loss of power while en route from Fort McMurray to Fort Chipewyan. The pilot successfully negotiated an emergency landing in brush about 175 kilometers north of Fort McMurray. Two helicopters were dispatched to the scene and transported all persons back to Fort McMurray where they were treated for their injuries and released.
September 8, 2010	A semi-tractor trailer carrying 50,000 liters of diesel fuel experienced a tire rupture on highway 63, 15 kilometers north of Boyle, Alberta. The resulting friction caused a fire that completely destroyed the vehicle. Traffic on highway 63 was re-routed for 8 hours as responders cleared the wreckage, cleaned spilled fuel from ditches and repaired the road surface.
October 25, 2010	Twin engine aircraft crash at Kirby Lake, near Conklin. Alberta Health Services confirmed that there was 1 Fatality, 3 critically injured, 1 seriously injured and 5 stable personnel involved.
October 27, 2010	Major gas leak at 104 Loutit Road, Timberlea. High

<b>HISTORICAL INCIDENTS</b>	
<b>REGIONAL MUNICIPALITY OF WOOD BUFFALO</b>	
<b>DATE</b>	<b>EVENT</b>
	pressure gas line was struck approximately 15-20 feet from condo buildings. Residents in nearby condos were evacuated for a short period of time. ATOC responded and quickly capped the leak.
December 19, 2010	A natural gas line was struck on Sutherland Avenue and gas was shut off to MacDonald Island, River Park Glen (The Towers), Franklin Inn and Suites Hotel and 100 Richardson Street. It took several hours for the gas line to be capped and for gas to be turned on to the surrounding buildings.
January 6, 2011	An explosion and fire originating in an upgrader at the Canadian Natural Resources (CNRL) Horizon Oil Sands site, about 75 kilometers north of Fort McMurray. This incident, which injured four workers, resulted in an orderly shutdown of the facility, but a site evacuation was not required. Officials at the Fort MacKay First Nation, upon notification from CNRL staff, monitored air quality around the community, as did the Wood Buffalo Environmental Association.
March 11, 2011	An Order was delivered to the Penhorwood Condo Association creating the need to evacuate 168 units in 7 buildings. The Order was given by Superior Safety due to a Structural Engineering report that advised of structural deficiencies in all 7 buildings. Approximately 350 occupants were evacuated and the Penhorwood Taskforce was created to assist residents in those buildings.
April 23, 2011 12:40pm	River Breakup 2011
May 15, 2011	Several wildfires were ignited due to human causes. Wildfire 4, 7, 8, 10 were eventually named the Bitumont

HISTORICAL INCIDENTS REGIONAL MUNICIPALITY OF WOOD BUFFALO	
DATE	EVENT
	Complex and an Area Command was created to deal with these fires. Fire 007 is the largest wildfire in Alberta's recorded history. Several camps had to relocate workers and CNRL, Kearl and Aurora had to close down operations for a period of time as the wildfire swept through their operations.
June 23, 2011 12:30pm	CN rail had a 6 car derailment 2 miles South of Anzac. The cars were carrying 500,000 kgs of sulphur.
July 16, 2011	An armed man was held up in his home for 15 hrs while RCMP negotiated with him to come out. 30 residents of Eagle Ridge Gate and Loutit Road were evacuated and a reception centre was set up at St. Martha school for them. 52 evacuees were registered at the reception centre and 12 people were put up in accommodations overnight.

## HAZARD SUMMARY/DETAIL

For ease of organization and reference, the following is an alphabetical listing of hazard groups and the related hazards within each groups and the detail of each hazard.

Hazard Group	Hazard
Atmosphere	<ul style="list-style-type: none"> <li>• Blizzards, Snowstorms, Ice Storms</li> <li>• Hail</li> <li>• High Winds</li> <li>• Lightening</li> <li>• Thunderstorm</li> <li>• Tornado</li> </ul>
Collisions (Transportation)	<ul style="list-style-type: none"> <li>• Airplane Crash</li> </ul>

Hazard Group	Hazard
	<ul style="list-style-type: none"> <li>• Roadway Collision</li> <li>• Train Collision/Derailment</li> </ul>
Dangerous Goods/ Hazardous Materials	<ul style="list-style-type: none"> <li>• Biohazard materials</li> <li>• Dangerous goods spill</li> <li>• Dangerous goods storage</li> </ul>
Diseases and Epidemics	<ul style="list-style-type: none"> <li>• Human Disease/Public Health Threat</li> <li>• Pest Infestation</li> <li>• Plant Diseases</li> </ul>
Explosions and Emissions	<ul style="list-style-type: none"> <li>• Industrial Facility</li> <li>• Oil and Gas plant or well accident</li> <li>• Pipeline break/release</li> </ul>
Fire	<ul style="list-style-type: none"> <li>• Urban Interface/Wildland fire</li> <li>• Industrial fire</li> <li>• Landfill</li> <li>• Urban/Rural structure</li> </ul>
Geological/Hydrological	<ul style="list-style-type: none"> <li>• Flood (surface)</li> <li>• Flood (waterways)</li> <li>• Landslide</li> </ul>
Public Disorder	<ul style="list-style-type: none"> <li>• Civil disorder</li> <li>• Labour Disputes</li> </ul>
Structural	<ul style="list-style-type: none"> <li>• Structural Collapse</li> </ul>
Terrorism	<ul style="list-style-type: none"> <li>• Hostile Acts</li> </ul>
Utility Disruption	<ul style="list-style-type: none"> <li>• Communication/Telephone failure</li> <li>• Heating/Natural Gas Disruption</li> <li>• Power</li> <li>• Water Contamination/Storage</li> </ul>

## **ATMOSPHERE**

There are four distinct seasons within the municipality: winter, spring, summer and autumn. While winters can be long, cold and snowy and the summers are usually warm and dry, these conditions are not necessarily the rule. The region has experienced milder winters, with less than anticipated levels of snowfall and some spring and summer months have been wet, with higher than average levels of precipitation and accompanying moderate temperatures. Weather related effects have devastating affects on an increasing urban population and can result in widespread damage, injuries, deaths, flooding and traffic disruptions.

### **Blizzards/Snowstorms**

A severe winter storm or blizzard occurs when heavy snowfall is accompanied by strong winds, blowing/drifting snow, and decreasing temperatures.

Situated in Northern Alberta at 56 degree north latitude, the region has the potential for facing more severe winter weather-related hazards than any other municipality of comparable size in North America. At times, temperatures can drop dramatically. On February 1, 1947 the temperature in the Fort McMurray area dropped to minus 50.6 degrees Celsius proving to be the coldest day between the years 1940 - 2009.

In winter, one of the greatest, most consistent factors that must be dealt with is the cold. In times of extreme cold, machinery breaks or malfunctions, vehicles fail to start and water lines freeze and burst, causing flooded streets that turn into sheets of ice. Demand for heating fuel is acute, schools close, humanitarian shelters become overcrowded, and incidents of hypothermia and death increase dramatically.

During winter the potential exists for life threatening blizzards and heavy snowfalls. An example is listed below:

DATE	EVENT
February 19, 2009	A blizzard arrived slowly from Southwestern Alberta, affecting an area from Mariana Lake north to Fort McMurray. Several motorists were stranded on Hwy. 63 while crews worked to clear the roads.

Spring snowstorms can also regularly occur in the region. A significant event in recent years was:

DATE	EVENT
April 22, 2008	A three day snow storm with a large accumulation of snow on roadways resulted in an activation of the Municipality's EOC to develop contingency plans for the delivery of vital services in and around the Urban Service Area of Fort McMurray.
April 9-11, 2010	A three day snow storm in the Regional Municipality of Wood Buffalo blanketed the region with 30 cm of snow in 3 days. Several motorists were stranded on Hwy 63 and 881 and on local residential streets while road crews worked to clear the roads. Power outages occurred within the urban centre of Fort McMurray leaving residents without power for a couple of hours as repair crews navigated the snowy roads. The local landfill site was closed due to impassable roads.

There are many factors that can affect the impact of a winter storm other than the amount of snow received. They include speed of the prevailing winds (drifting), freezing rain (prior to snowfall), and the time period of the snowfall. Generally, significant snowfall over a short period of time affects The Regional Municipality of Wood Buffalo's ability to react to and manage the event. This is more so than snow falling at a slower consistent rate, but both scenarios have the potential to cause their own unique problems.

During a major snowfall, the Regional Municipality of Wood Buffalo – Bylaw Department in conjunction with RCMP enforces parking bans on designated snow

routes to allow for snow removal. Snow removal equipment can be mobilized, theoretically within a moment's notice through the Regional Municipality of Wood Buffalo – Public Works Department. At any given time, though, a percentage of the fleet may be unavailable due to some type of mechanical maintenance.

The Regional Municipality of Wood Buffalo – Road Maintenance Division has emergency equipment to respond to snow/blizzard events and if more equipment is required they maintain a list of a list of available contracted equipment can be utilized to supplement Municipal equipment, if required.

### **Ice Storms**

When winter precipitation falls as freezing rain or drizzle, heavy ice accumulations (ice storms) can cause significant damage, especially when accompanied by high winds.

The climate within the municipality is such that during the most likely periods for ice storms, (like those in Quebec and Ontario), there is very little moisture in the air, reducing the number of ice storms considerably. There are times, however, when freezing rainfall will dramatically affect traffic flow for several hours, and can cause hazards for pedestrians.

### **Hail**

Hail forms in the core of thunderstorms. Water vapor in warm, rapidly rising air masses (convection currents) condenses into water at higher, cooler altitudes, producing heavy rain showers. If it is cold enough, ice crystals can form around minute particles of dust whipped up from the ground. These increase in size as more water freezes to their surfaces. When the ice pellets are too heavy for the ascending air currents to lift, they fall as hail. They may become larger, heavier and more damaging if they collect more water during their descent. Damage from hail can have a devastating impact: flattening crops and gardens, stripping trees and

plants of foliage, damaging roofs and other property, and creating icy roadways, resulting in treacherous driving conditions.

Not all hailstorms are widespread. Within the municipality, many areas can experience a hailstorm while, at the same time, other areas in the region remain unaffected. An example of a hailstorm that caused significant property damage in the last couple years has been:

DATE	EVENT
August 2, 2007	Large hail storm impacted residents of the residential Prairie Creek residential sub/division in Fort McMurray residents damaging houses, cars and landscape.

### High Wind

Often confused with tornado activity, high winds are straight-line winds or microbursts in excess of 80 kilometers per hour (km/h) that may cause adverse affects to life or property. An example of a high wind incident that occurred:

DATE	EVENT
Summer 2007	A tornado in the Lac La Biche area created high winds that affected the Conklin area.

### Lightning

During a thunderstorm, the air is charged with electricity and the most striking sign is lightning. The bottoms of thunderclouds carry negative charges, while the tops carry positive charges. Influenced by the charged clouds, the ground also becomes positively charged. When the electric build-up becomes too great, the lightning jumps from the negatively charged cloud base to a positively charged object. While the majority of lightning activity is between clouds, roughly one-third strike the ground.

Lightning can start devastating fires, usually in the dense and unpopulated forest areas in Alberta. As well, power outages may be experienced when a power line or transformer station takes a direct hit. An example of a lightning strike that caused significant problems in the last couple years has been:

DATE	EVENT
May 17, 2002	The House River Wildfire, ignited by lightning and engulfed 238,867 hectares, temporarily displaced residents of Conklin.
June 27, 2010	A series of lightning strikes resulted in wildfires on the northern edge of the municipality and Wood Buffalo National Park. A wildfire in northern Saskatchewan that burned over 300,000 hectares brought smoke into the region, affecting and causing concern within the communities of Fort Fitzgerald and nearby Fort Smith, NT.

### **Thunderstorms**

A severe thunderstorm consists of most of the following elements: heavy rainfall, moderate to strong winds, hail, lightning, and the risk of flash flooding or surface flooding.

Despite the havoc they can cause, severe thunderstorms are small-scale and short-lived as a weather phenomenon. Through the assistance of several volunteer weather-watchers, timely and accurate observations of severe weather are an invaluable supplement to Environment Canada's full observation network. Environment Canada closely monitors weather systems and will issue applicable watches, warnings, and updates to ensure public safety.

### **Tornadoes**

A tornado is a violent funnel-shaped, destructive, rotating column of air with wind speeds that can exceed 511 km/h (300 mph). Path widths can range from a few

metres to over 1.3 kilometres. The average forward speed is 40 km/h (25 mph), but can exceed 130 km/h (80 mph).

Tornadoes are classified according to the *Fujita F-Scale of Severity*:

- F-0 (64-116 km/h) - light damage (broken branches, etc.)
- F-1 (117-180 km/h) - some minor roof damage (can overturn mobile homes)
- F-2 (181-252 km/h) - strong (can remove a roof or demolish a mobile home)
- F-3 (254-331 km/h) - severe damage
- F-4 (332-418 km/h) - devastating damage
- F-5 (419-511 km/h) - incredible damage (very rare)

On average there are 41 tornadoes reported in the prairies per year (16 per year in Alberta). The other Canadian “hot spot” for tornadoes is southwestern Ontario. Canada is second in the world to the United States for frequency of tornadoes.

Environment Canada, through the Prairie Storm Prediction Centre in Winnipeg, issues public broadcasts, weather watches, and warnings for Alberta, Saskatchewan, and Manitoba. The Centre has expertise in predicting severe weather and consolidates efforts previously carried out by facilities located in several locations across the prairies. Using specially trained warning preparedness meteorologists, the Centre has an important training and educational role with schools, emergency response organizations, and media.

The Centre receives information from a variety of sources across the prairies including weather stations, police, and other emergency responders. As well, Environment Canada has developed the Canwarn System, which relies on hundreds of specially trained amateur radio volunteers to identify tornado precursors.

## DANGEROUS GOODS/HAZARDOUS MATERIALS

As identified in the Transportation of Dangerous Goods Act and Regulations, a dangerous good is *"any article or substance that is capable of posing significant risk to health, safety or property when transported."* The Act provides for nine classifications of dangerous goods (also known just as "DG" or hazardous materials), sets the standards for the safe movement of these materials and, identifies the documentation; safety marks (labels/placards) and training requirements. In addition, the Act specifies emergency incident reporting criteria and the circumstances when specific emergency response plans are required.

Transportation of Dangerous Goods Act and Regulations classification system:

Class 1 - Explosives
Class 2 - Compressed Gases
Class 3 - Flammable liquids
Class 4 - Other flammable hazards
Class 5 - Oxygen rich material, oxidizers and organic peroxides
Class 6 - Material affecting health, poisons and infectious substances
Class 7 - Radioactive material
Class 8 - Corrosive material
Class 9 - Miscellaneous hazards

In the municipality, high volumes of various dangerous goods are produced or shipped to and through the municipality by road on an annual basis. The majority is manufactured or reaches their destination without incident. Mishaps, however, can and do occur.

### Biohazard Materials

Biohazard materials are substances that are hazardous to humans and can include materials such as AIDS viruses, infectious samples, or bacterium. Specialized

packaging and transport requirements usually provide safe protection. If any product escapes, response mechanisms exist to contain and mitigate their effects.

An emerging area of concern is the intentional manufacture and release of biological agents such as anthrax or smallpox. The terrorist attacks of September 11, 2001 and the subsequent anthrax scares in the United States increased the number of **false** reports in Alberta. Any white or powdered substance created suspicion and many agencies throughout Alberta were kept busy responding, as were numerous other North American cities. All were deemed to be innocuous substances and, to date, there are no confirmed cases of intentional biological releases or attacks in Canada. Federal agencies monitor the situation.

### **Dangerous Goods Spill**

A Dangerous Goods spill is the accidental release of chemical, biological, or radiological material during transportation or handling at a fixed site. Under the Alberta Environmental Protection and Enhancement Act “*a release includes the spill, discharge, dispose of, spray, inject, inoculate, abandon, leak, seep, pour, emit, empty, throw, dump, place and exhaust*” of a substance that causes the “*impairment of or damage to environment, human health or safety of property*”.

In 1980, the federal government passed the Transportation of Dangerous Goods Act (TDGA). It promotes public safety when transporting dangerous commodities, including chemicals. It applies, with specific exceptions, to all handling, offering for transport, and actual carrying of dangerous goods in Canada irrespective of their point of origin, destination, or means of conveyance.

On September 5, 1980, a system of dangerous goods transportation routes was proposed and implemented shortly thereafter. In July, 1985, the first regulations under the TDGA came into force and applied to all modes of transportation.

A classification system has been established for response to dangerous goods incidents. Each level of response requires different levels of resources to effectively correct or deal with a situation (as seen in the chart below):

Level I Spill	A small spill (less than 25 litres) involving any class of dangerous goods transported or stored in vehicle systems, pails, drums, cylinders (except one ton), packages, bags, etc., and having a low risk of fire/explosion, environmental contamination, or impact on human health and safety. The container is either undamaged or a small release has occurred that can be contained with available resources. Single pump response.
Level II Spill	A spill (less than 100 litres) usually involving placarded quantities of dangerous goods transported or stored in cylinders, tanks, drums, multiple small packages, etc., having a medium risk of fire/explosion or environmental contamination and requiring some consideration for local evacuation. Containers may be damaged but capable of holding the contents for transporting from the event. Single pump, Dangerous Goods Response Team response.
Level III Spill	A spill involving extremely hazardous substances transported, confined, or stored in buildings, tank cars/trucks, stationary tanks, multiple medium sized containers, etc., having a high/severe risk of fire/explosion or environmental contamination and requiring consideration for large scale evacuation. Containers may be damaged to a degree that catastrophic failure is possible. First Alarm required units, Dangerous Goods Response Team, Emergency Medical Services (EMS) response.

*If an incident escalates, additional resources are called upon as needed to bring the incident to a safe conclusion.*

Hundreds of loads of dangerous goods are transported daily through the municipality by truck. Loads can include large quantities of individual products or mixed loads that, in the event of an accident, can lead to deadly consequences.

Most incidents of chemical and other toxic material accidentally released within the municipality have been of a minor nature.

DATE	EVENT
November 13, 2007	A single vehicle rollover involving a tanker carrying dangerous goods (Ammonia Hydroxide) on Hwy. 63, south of Hwy. 69 intersection, resulting in a temporary closure of north and south lanes of Hwy. 63.
January 22, 2010	A tanker carrying dangerous goods (Sulfur) while travelling south on Hwy. 63 approximately 4 kilometers north of Fort McMurray, resulting in a temporary closure of both the north and south bound lanes on Hwy. 63.
April 9, 2010	A tanker carrying 20,000 litres of dangerous goods (diesel) on Hwy 63 North rolled over spilling fuel onto the roadway and surrounding area. It is unknown how much spill but one lane was closed down to accommodate the cleanup of the spill.
April 20, 2010	Regional Emergency Services responded to a dangerous goods incident at the Fort McMurray Hospital. The incident was the result of a small dangerous goods spill in the Lab. The mitigation of the spill was completed in about an hour. The hospital followed their Emergency Response Plan and evacuated the lab and nearby Records Department.
June 10, 2010	A fire broke out in the Mildred Lake Facility Plant 7-3 Diluents Recovery Unit (DRU) operated by Syncrude Canada Ltd. that took just over an hour to extinguish. Of the 5 workers transported to hospital with burn injuries, 2 were treated and released, while 3 were air lifted to an Edmonton hospital.
July 9, 2010	An unplanned release of hydrogen sulphide (H <sub>2</sub> S) and ammonia from a C-4 overhead drum due to the failure of a weld occurred at the Mildred Lake Facility Plant operated by Syncrude Canada Ltd. Workers were immediately evacuated, two of whom sustained minor injuries and were taken to hospital for treatment.
July 10, 2010	A well blowout occurred in a remote location near Conklin. Devon Canada stopped the blowout using increased water

DATE	EVENT
	pump rates down the injection well and production well. Containment and absorbent booms were deployed on the Monday Creek containing the hydrocarbon sheen.
September 3, 2010	Highway 63 was temporarily closed and traffic diverted to highway 881 due to a fire on a Super-B tanker as a result of a double tire blowout, approximately 10 kilometers south of Wandering River. The vehicle was carrying 50,000 liters of diesel fuel with a minimal amount released, much of which was consumed in the fire. A small amount had migrated to a ditch, but was contained by emergency responders. The highway was re-opened 6 hours later.
June 23, 2011 12:30pm	CN rail had a 6 car derailment 2 miles South of Anzac. The cars were carrying 500,000 kgs of sulphur.

### Dangerous Goods Storage

Dangerous Goods storage constitutes large quantities of stored chemical, biological and radiological materials at a fixed site. Accidents or leakage can result in a threat to life and property, or contamination of the environment.

Chemical distributors, storage, and manufacturing facilities within the municipality are very diligent regarding ongoing training of staff and maintaining high levels of monitoring of all aspects of their operation for hazardous incidents.

DATE	EVENT
January 3, 2009	Approximately 4,000 barrels of oil leaked from a pipe at the Enbridge Pipelines Inc. Cheecham Terminal Tank Farm, situated approximately 20 kilometers south of Anzac, Alberta. Most of the oil spill was held within containment berms that ring the tank farm. A small amount of oil sprayed into the air, drifting onto nearby snow and trees.

## DISEASES AND EPIDEMICS

### Infectious Diseases/Public Health Threat

A public health threat is a medical, health, or sanitation occurrence such as contamination, epidemic, or infestation that poses a threat to the general public.

Historic public health threats in the Regional Municipality of Wood Buffalo:

DATE	EVENT
1784	The Chipewyan First Nation population suffered 90% fatalities during a smallpox epidemic, a reaction to first contact with the disease, (source: Alberta Online Encyclopedia).
1881	Smallpox ravished the Chipewyan First Nation. (source: Fort Chipewyan Education North Society 1983)
1920 - 21	Spanish Flu in Fort Chipewyan killed many people. Mass graves were dug at a location where the Northern Store now stands. (source: Fort Chipewyan Education North Society 1983)
2009	Human Swine Influenza – H1N1 Virus as of June 9, 2009 there were 2115 cases with 3 deaths in Canada and 171 confirmed cases in Alberta.

### Vaccination Campaigns

The municipality is as vulnerable to a major health threat as any Canadian region its size. Increased travel, the mobility of populations, and increased imports also increases the chances of swift transmission of human-borne diseases. The probability of a major health threat occurring, however, is difficult to predict. The following table reflects previous vaccinations programs implemented throughout the Province of Alberta:

DATE	EVENT
1976	Swine flu
1979	Measles

1997	Measles
2000-2001	Meningococcal disease
2009	H1N1
Every Year	Influenza vaccination campaign
Every Year	Grade 5 Hepatitis B vaccination
Catch-up Program	Grade 12 Hepatitis B vaccination

## **Pest Infestation**

### ***Deer Mice/Hantavirus Pulmonary Syndrome***

Hantavirus has existed previously for some considerable time. The disease is contracted following exposure to infected mouse droppings or urine. The deer mouse *Peromyscus maniculatus* has most frequently been responsible for transmission of Hantavirus to humans.

Safety information is provided to the Regional Municipality of Wood Buffalo employees and residents on what to do and further public education information is provided by Alberta Health Services on how to minimize exposure risk to Hantavirus.

### ***Invasive Pest Species***

In general, native insects such as the forest tent caterpillar can cause much alarm to citizens when population cycles peak and trees are stripped of their leaves. Natural control of these outbreaks mediated by many different natural enemies limits the damage to trees and in time causes the pest outbreak to subside. Similar outbreaks of non-native pests are less likely to resolve naturally. This can have more harmful or sometimes serious consequences on tree survival. Federally designated quarantine pests like the Asian gypsy moth or the Asian long-horned beetle are examples that warrant emergency measures due to the environmental destruction these species will cause if left unchecked.

The status of quarantined pests is assessed through the use of monitoring devices and inspections conducted under the auspices of the *Quarantine Act*, R.S.C. 1985, c. Q-1. Typically the presence of these insects in the municipality would generate resource assistance from provincial and federal agencies under the Critical Pest Infestation Response Plan if municipal government resources were insufficient to eradicate the problem.

### ***Mosquitoes/Mosquito-Borne Diseases***

The wetter summer months of June and July typically produce heavy nuisance mosquito activity within the region. Invasions of mosquitoes regularly pose serious annoyance, which curtails many outdoor activities. The build-up of nuisance mosquito populations which breed quickly in more temporary standing water bodies over the land follows cycles in the availability of wetter conditions. The risk of human disease transmission by local mosquito species has lowered since outbreaks of Western Equine Encephalitis in central Alberta in the 1930s that caused horse and human deaths.

However climate change coupled with the introduction of new species of mosquito vectors, (Asian tiger mosquito), and new mosquito-borne diseases in Canada,

(West Nile virus), the health risk has increased that as these new species are spreading towards Alberta and require ongoing evaluation.

The species of mosquitoes that carries the West Nile Virus has not been found this far north, which minimizes the priority of spraying programs. Public education information can be found on the Alberta Government websites on how to limit exposures and what to do on your property to limit mosquito breeding areas.

### ***Plant Diseases***

Dutch Elm disease (DED) threatens thousands elms planted on public and private property throughout the Regional Municipality of Wood Buffalo. This non-native

disease has ravaged American elm populations throughout the United States and south central and eastern Canada. The disease spreads from infected to healthy elms that are growing close enough together, by means of their inter-connecting root systems. In addition, broods of elm bark beetles emerging from infected elms physically transmit spores of the fungal disease to healthy elms by feeding on the vascular tissues of the tree. Long distance movements of the disease are typically mediated by human-assisted transmission such as the movement of disease-infected or vector-infested elm firewood. Whereas this species is non-native, and likely receives little control by natural enemies, the municipality's winters appear to be the main reason populations of this disease vector remain at lower levels.

Prevention is the best control measure for DED. Through provincial initiatives and the Municipality's website, residents are informed about the disease and the type of wood they bring into the province. Once the disease is discovered insecticide applications for bark beetles, fungicide injection, and root graft separation are done to decrease the spread of DED. Additional information can be found on the Regional Municipality of Wood Buffalo's website:

<http://www.woodbuffalo.ab.ca/residents/parks+recreation/newsletter.asp?subnav=5>

## **EXPLOSIONS AND EMISSIONS**

Throughout the municipality there are a number of large industrial facilities. Manufacturing or processing a variety of products from cement to chemicals, cellulose fibers to petroleum and natural gas, these huge plants are made up of a sophisticated network of pipes, pressurized chambers and vessels, gauges, control panels and other related systems. In addition, the prairie landscape is dotted with oil and gas pumps, controlling the flow of product. These types of facilities and the oil and gas industry are heavily regulated by the federal and provincial governments to ensure the safety of the public and the environment.

## Explosions

An explosion occurs when there is a sudden increase in volume and release of energy in an extreme manner, usually with the generation of high temperatures and the release of gases. Within the municipality there are a variety of industries that have a selection of chemicals being used and stored that could lend themselves to causing an explosion. An example of an explosion is seen in the table below:

DATE	EVENT
June 1, 2009	Explosion at the Syncrude, Mildred Lake site injuring four and sending two to hospital.
January 6, 2011	An explosion and fire originating in an upgrader at the Canadian Natural Resources (CNRL) Horizon Oil Sands site, about 75 kilometers north of Fort McMurray. This incident, which injured four workers, resulted in an orderly shutdown of the facility, but a site evacuation was not required. Officials at the Fort MacKay First Nation, upon notification from CNRL staff, monitored air quality around the community, as did the Wood Buffalo Environmental Association.

## Emissions

The Wood Buffalo Environmental Association (WBEA) monitors the air in the region 24 hours a day, 365 days a year. This is completed through a variety of air, land and human monitoring programs that collect the information and openly share it with stakeholders and the public, (source: <http://www.wbea.org/>).

The WBEA exists to:

- Determine air quality trends;
- Alert industry and government to changes in air quality;

- Review effectiveness of emission control measures;
- Provide data for scientific studies;
- Make air quality information available for our neighbors; and
- Provide real-time (or immediate) data 24-hours a day, seven days a week.

Air quality is affected by emissions from industrial operations, motor vehicles, home heating, and natural biological processes. Weather conditions (precipitation, temperature and wind) also affect the measured quality of ambient air.

**The Ambient Air Technical Committee** is the backbone of the WBEA. The committee meets at least once a month to ensure that credible, accurate and timely collection of continuous, intermittent and passive air quality data remains constant.

They operate the largest air shed in the largest municipality in the country. The Wood Buffalo air information line was launched on August 1, 2008 to provide a means for the public to receive up-to-date information during odours and other air events in the region (i.e forest fires, odour events, industry exceedances to cautionary reports related to performing scheduled facility maintenance or flare-ups.)

DATE	EVENT
July 15, 2010	Poor air quality advisory was issued due to forest fires in Northern Alberta and Saskatchewan. Alberta Health Services advised residents of Fort McKay, Fort McMurray, Fort Chipewyan, who have respiratory health problems to take care and stay indoors.
May 26, 2011	Alberta Health Services issued an air quality advisory due to the wildfires in Northern Alberta. Alberta Health Services advised residents of Fort McKay, Fort McMurray, Fort Chipewyan, who have respiratory health problems to take care and stay indoors. The advisory was re-sent out on June 2, 2011 and Nunee Health also sent out a Health Advisory on June 2, 2011.

There are 16 air quality monitoring stations established in and around the Municipality to measure general (or ambient) air quality as listed hereafter. One station, however, has been decommissioned.

### **Fort MacKay (AMS 1)**

The Fort McKay Station is located near the northwest corner of the Fort MacKay Water Treatment Plant. This station was built in the fall of 1997 and replaced a nearby station operated by Alberta Environmental Protection. The Fort McKay station contains analyzers that continuously measure SO<sub>2</sub>, TRS, THC, O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>2.5</sub>, global radiation, leaf wetness, humidity, wind speed and direction, and the temperature at a height of 2 m and 10 m. A tipping bucket rain gauge measures precipitation during the summer. Non-continuous measurement devices include a PM 10, VOC's, chemical analysis of precipitation, semi-volatile organic compounds and several passives, (source: <http://wbea.org/content/view/62/216/>).

### **Mildred Lake (AMS 2)**

The Mildred Lake station is located at the Syncrude Canada Ltd. airstrip, in an orange building. This station was originally part of their air monitoring network. There is a radio antenna on the tower that receives signals from the Buffalo viewpoint station (station 4) located in Syncrude Canada Ltd. South Mine. There are no telephone lines available in the South mine, so two pairs of radios transmit data from station 4 and station 2. The Mildred Lake station contains analyzers that continuously measure SO<sub>2</sub>, H<sub>2</sub>S, THC, wind speed and direction, and temperature, (source: <http://wbea.org/content/view/66/220/>).

### **Lower Camp Met Tower (AMS 3)**

This station was originally part of the air monitoring network operated by Suncor Energy Ltd. in an orange building. It contained analyzers that continuously measured SO<sub>2</sub>, H<sub>2</sub>S, and THC. Due to proximity to an unsuitable microclimate, the

continuous analyzers were moved to a new station (station 11) located nearby. The meteorological tower is still operating at station 3 in the original location. The lower portion of a tower that is 167 meters high at heights of 20 m, 45 m, 100 m and 167m there are sets of instruments that measure temperature, horizontal wind speed and direction, and vertical wind speed, (source: <http://wbea.org/content/view/64/218/>).

#### **Buffalo Viewpoint (AMS 4)**

The Buffalo viewpoint station is located at the south end of Syncrude Canada Ltd. South Mine and was originally part of their monitoring network. There are no telephone lines available there, so two pairs of radios transmit data from station 4 to station 2. The Buffalo Viewpoint station contains analyzers that continuously measure SO<sub>2</sub>, H<sub>2</sub>S, THC, wind speed and direction, and temperature, (source: <http://wbea.org/content/view/60/213/>).

#### **Mannix (AMS 5)**

This station was originally part of the air monitoring network operated by Suncor Energy Ltd. located in the orange building. It contains analyzers that continuously measure SO<sub>2</sub>, H<sub>2</sub>S, and THC.

On the lower portion of the tower at heights of 20 m, 45 m, 75 m there are sets of instruments that measure temperature, horizontal wind speed and direction, and vertical wind speed. There is an additional temperature device at a height of 2m., (source: <http://wbea.org/content/view/65/219/>).

#### **Patricia McInnes (AMS 6)**

The Patricia McInnes station is located on the west edge of Fort McMurray's Timberlea subdivision. This station was built in the fall of 1997.

The Patricia McInnes station contains analyzers that continuously measure SO<sub>2</sub>, TRS, THC, O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>2.5</sub>, NH<sub>3</sub>, wind speed and direction, and temperature. Non-continuous measurement devices include a PM<sub>10</sub>, VOC's, chemical analysis of precipitation, semi-volatile organic compounds and several passives, (source: <http://wbea.org/content/view/68/222/>).

### **Athabasca Valley (AMS 7)**

The Athabasca Valley station is located just off the road that takes one to McDonald Island. This station was built and operated by Government of Alberta Environment until it's responsibility was turned over to the WBEA in the fall of 1997.

The Athabasca Valley station contains analyzers that continuously measure SO<sub>2</sub>, TRS, THC, O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>2.5</sub>, CO, wind speed and direction, and temperature. Non-continuous measurement devices include a PM<sub>10</sub>, VOC's, and semi-volatile organic compounds, (source: <http://wbea.org/content/view/58/211/>).

### **Fort Chipewyan (AMS 8)**

The Fort Chipewyan station overlooks Lake Athabasca on the outskirts of Fort Chipewyan. This station was constructed during the summer of 1998.

The Fort Chipewyan station contains analyzers that continuously measure SO<sub>2</sub>, O<sub>3</sub>, NO, NO<sub>2</sub>, PM<sub>2.5</sub>, wind speed and direction, temperature, global radiation, leaf wetness, and humidity, (source: <http://wbea.org/content/view/61/215/>).

### **Barge Landing (AMS 9)**

The Barge Landing station is located on the Barge Road off of Highway 63, north of Fort McKay. This station was built as an Shell Canada Limited Station and donated to the WBEA in 2001.

The Barge Landing station contains analyzers that continuously measures TRS, THC, wind speed and direction, and temperature. VOC's are measured intermittently, (source: <http://wbea.org/content/view/59/212/>).

### **Albian Mine Site (AMS 10) – Non Operational**

The Albian Mine North Station was located on the Shell Canada Limited site. The station was built by Albian Sands Energy Ltd., and donated to the WBEA in 2001.

AMS 10 – Albian Mine was decommissioned on February 4, 2009, to make way for mining at its location and was replaced with AMS 16 – Albian Muskeg River, located about 4 km southeast of Albian Mine, commenced operation on February 10, 2009, (source: <http://wbea.org/content/view/55/209/>).

### **Lower Camp (AMS 11)**

The Lower Camp station was originally known as station 3, part of the air monitoring network operated by Suncor Energy Ltd. Due to proximity to an unsuitable microclimate, the continuous analyzers were moved to a new station located nearby. The meteorological tower is still operating at station 3 in the original location.

The Lower Camp station contains analyzers that continuously measure SO<sub>2</sub>, H<sub>2</sub>S, THC, wind speed and direction, and temperature, (source: <http://wbea.org/content/view/63/217/>).

### **Millennium Mine (AMS 12)**

This station was originally placed at the south end of the Suncor Energy Ltd. Mine. The station was moved to a new located across the bridge on the Suncor plant site due to logistical difficulties with the original site.

The Millennium Station contains analyzers that continuously measure SO<sub>2</sub>, TRS, THC, NO, NO<sub>2</sub>, NOX, PM<sub>2.5</sub>, wind speed and direction, and temperature. Non-continuous measurement devices include a PM 10 and VOC's, (source: <http://wbea.org/content/view/67/221/>).

### **Syncrude UE-1 (AMS 13)**

The Syncrude UE-1 station is located between the community of Fort McKay and the Syncrude Canada mine site.

The Syncrude UE-1 station contains analyzers that continuously measure SO<sub>2</sub>, O<sub>3</sub>, TRS, THC, NO, NO<sub>2</sub>, NOX, PM<sub>2.5</sub>, wind speed and direction, and temperature. Non-continuous measurement devices include VOC's and PM 10, (source: <http://wbea.org/content/view/69/223/>).

### **Anzac (AMS 14)**

The Long Lake project monitoring station, designated as Anzac, is located approximately 35 km southeast of Fort McMurray on the northern edge of the hamlet of Anzac. The elevation of the monitoring station is approximately 1624 ft (495 m) above sea level.

The Anzac station contains analyzers that continuously measures SO<sub>2</sub>, O<sub>3</sub>, TRS, THC, NO, NO<sub>2</sub>, NOX, PM<sub>2.5</sub>, wind speed and direction, and temperature, (source: <http://wbea.org/content/view/57/210/>).

### **CNRL Horizon (AMS 15)**

The CNRL Horizon station is located in the Regional Municipality of Wood Buffalo, 75 km Northwest of Fort McMurray, Alberta near Fort McKay. The air quality station is a requirement of Alberta Environment.

The CNRL Horizon station contains analyzers that continuously measure SO<sub>2</sub>, TRS, THC, NO, NO<sub>2</sub>, NO<sub>X</sub>, PM<sub>2.5</sub>, wind speed and direction, and temperature. Non-continuous measurement devices include VOC's and PM<sub>10</sub>, (source: <http://wbea.org/content/view/85/214/>).

### **Albian Muskeg River (AMS 16)**

The Albian Muskeg River station, located about 4 km southeast of the decommissioned Albian Mine Site (AMS 10), commenced operation on February 10, 2009.

The Albian Muskeg River station contains analyzers that continuously measure NO<sub>2</sub>, SO<sub>2</sub>, THC, PM<sub>10</sub>, wind speed and direction, and temperature. PM 10 and PM 2.5 are measured intermittently, (source: <http://wbea.org/content/view/108/254/>).

### **Other Monitoring Resources**

In addition to the air quality monitoring stations, there are two committees established:

**The Human Exposure Monitoring Committee** is a committee consisting of membership including representation from Alberta Health and Wellness, Health Canada and the Wood Buffalo Environmental Association. The committee meets a minimum of four times per year to design and instigate a long-term human exposure monitoring strategy to answer questions about the quality of the air people are exposed to in their daily lives. Other tasks include: identification of monitoring methods, recruiting volunteers, setting up sampling schedules, and communicating the program and its results to the Wood Buffalo Environmental Association Board, Aboriginal and Non-Aboriginal communities, and other stakeholders throughout the municipality, (source: <http://www.wbea.org/content/view/32/73/>).

**The Terrestrial Monitoring Committee** is a committee consisting of representation from industry, government and First Nations who work with the Wood Buffalo Environmental Association to develop and operate a long term monitoring program to detect, characterize and quantify the impact that air emissions have had or may have, in the longer term, on terrestrial ecosystems and on traditional land resources within the municipality, (source: <http://wbea.org/content/view/71/137/>).

They operate various programs:

- Deposition Mapping, Receptor Modeling
- Bogs, Fens and Lichens
- Source Characterization
- NH<sub>3</sub> & HNO<sub>3</sub> Passive Monitoring
- Ier Resin samplers
- Foliar Wax Chemistry
- URg 9000D Ambient Ion Monitor
- TEK (blueberries)
- Site Replacement & Monitoring
- Impact Assessment Tool
- Estimating Acid & Nitrogen Deposition
- Dry Acid Deposition Measurement

A 24 hour/day Wood Buffalo Air Information Line (toll free: 1-866-685-3699) was established on August 1, 2008 that provides the means for the public to receive up-to-date information during odours and other air events in the region, (source: <http://wbea.org/content/view/94/202/>).

## **Industrial Facilities**

The municipality has a number of large industrial facilities involved in the processing of chemical and petro-chemical commodities. While each of these

facilities has excellent maintenance schedules and well-developed emergency response plans incidences have occurred.

## **Oil and Gas Well Accidents**

An oil and gas well accident is the uncontrolled release of oil or natural gas, or the extremely poisonous byproduct hydrogen sulphide from a production well. Hydrogen sulfide is a naturally occurring gas mixed with natural gas or dissolved in oil or brine.

Over the last 25 years, there have been many accidents involving sweet and sour gas wells within the municipality where varying amounts of product were released into the environment.

The petroleum and natural gas industry is highly regulated and has a sound safety record. The threat of accidental releases, fires, and explosions, however, still exists. In addition to these hazards, many of Alberta's oil and gas wells contain hydrogen sulfide.

At concentrations of 700 parts per million (PPM), as little as one breath of hydrogen sulphide can kill. Although hydrogen sulphide can be detected by a "rotten egg" odor in concentrations from .03 to 150 PPM, larger concentrations paralyze the olfactory nerves and deaden the sense of smell.

Small concentrations can cause coughing, nausea, severe headache, irritation of mucous membranes, vertigo, and loss of consciousness. Hydrogen sulphide forms an explosive mixture with air temperatures at 500°Fahrenheit (F) or above and is dangerously reactive with powerful oxidizing materials. Hydrogen sulphide can also cause the failure of high strength steel and other metals. This requires that all company and government responders be familiar not only with emergency procedures for well sites but also with the kinds of material that are safe for use in a sour gas well response.

## Hydrogen Sulphide Symptoms:

(source: [http://www.drthrasher.org/toxicology\\_of\\_hydrogen\\_sulfide.html](http://www.drthrasher.org/toxicology_of_hydrogen_sulfide.html))

Amount	Symptom
10 ppm	Onset of eye irritation.
50-100 ppm	Slight conjunctivitis and respiratory tract irritation after one hour.
100 ppm	Coughing, eye irritation, loss of smell after 2-15 minutes. Altered respiration, eye pain and drowsiness after 15-30 minutes. Throat irritation occurs after one hour. Several hours of exposure results in a gradual increase in severity of these symptoms and death may occur within 48 hours.
200-300 ppm	Marked conjunctivitis and respiratory tract irritation after one hour.
500-700 ppm	Loss of consciousness and possibly death in 30 minutes to one hour.
700-1000 ppm	Rapid unconsciousness, cessation of respiration, and death.
1000-2000 ppm	Unconsciousness at once with early cessation of respiration and death in a few minutes. Death may occur even if a person is immediately removed to fresh air.

## Pipeline Break/Release

A pipeline break/release is the accidental release of substances, liquid or gaseous, transported through an underground network of medium or large diameter pipes.

The municipality is surrounded and bisected by several pipelines. As well, a "Transportation Utility Corridor" runs through it. The lines transport a variety of products such as salt water, oil, nitrogen, hydrogen, natural gas, methanol, propane, ethane, and gasoline.

The pipeline industry in Alberta is regulated and monitored by the Energy Resources Conservation Board. They are responsible for regulating the safe, responsible, and efficient development of Alberta's energy resources.

The number of contact damage hits on pipelines continues to drop. Companies that fail to meet the requirements or follow Energy Resources Conservation Board direction are subject to escalating enforcement consequences. The required response and subsequent continued compliance with regulations results in the company's compliance status reverting back to satisfactory.

*The Pipeline Act* requires all pipeline licensees to report a pipeline failure to the Energy Resources Conservation Board regardless of cause, magnitude, or consequence. The Energy Resources Conservation Board verifies the cause of the failure and ensures that measures are taken to reduce future failures. A percentage of new pipeline installations are inspected for compliance with appropriate codes, acts, and regulations. As well, the Energy Resources Conservation Board conducts inspections on licensed systems to ensure that operators meet record and maintenance requirements for continuous pipeline integrity.

The most common reason for pipeline failure is third party contact with underground utilities and pipelines. Alberta First Call is an agency funded by pipeline and utility operations that contractors and property owners can contact to determine the location of underground utilities and pipelines.

In the event of an emergency, each pipeline operator maintains a 24-hour control centre and emergency shutdowns are initiated when notification is received. In most cases, a member from the pipeline operator's first response team will arrive on scene within 30 minutes. The team will work with site management teams from police and fire departments. Police and fire departments co-ordinate evacuation and safety measures while the pipeline company focuses on repair and restoration of the scene.

Not all pipeline breaks/releases involve hazardous products as many pipelines carry fresh or salt water.

DATE	EVENT
August 7, 2010	A release of tailings (a mixture of bitumen, water and dilutents) from a pipeline at the Canadian Natural Resources Ltd. (CNRL) Horizon plant outside of Fort McMurray. The release did breach the man-made dykes that would normally contain a release from the line, however the release did stay on the CNRL lease site.

## **FIRE**

### **Urban Interface/Wildfires**

The municipality has several scenic river valleys and an extensive park system. There are hundreds of traditionally manicured and natural parks located within the Fort McMurray Urban Service Area, as well as environmental reserves, agricultural and wild lands being held for future development.

Large grass fires have been a part of the municipality’s history since the fur trade.

Climatic conditions in the municipality have a strong bearing on the seasonal grass and brush fire situation. Snowfall, warm drying spring winds and rainfall dictate the extent and duration of the most hazardous periods. During normal years March, April, May, September and October are peak wild fire months.

Grass and brush fires can burn with such intensity that ecosystems can be drastically changed. Without intervention, these burned lands recover slowly and are susceptible to undesirable changes in vegetation composition. For example, when finer species of grass become established in burn areas replacing other vegetation, it disrupts natural systems combined with seasonal changes create additional fire risks.

Given the nature and quantity of urban and rural wild land in the municipality, grass and brush fires are unavoidable. Through concerted efforts of resource management and training of emergency response teams overall impacts can be lessened, but not eliminated. In times of low precipitation, the Province of Alberta – Sustainable Resource Development and the Regional Emergency Services Department will issue fire bans.

DATE	EVENT
May 29, 1995	The Mariana Lake Wildfire engulfed 132,679 hectares. The resulting in a closure of highway 63 cut off access to Fort McMurray and other northern communities, limiting supplies and other resources for several days.
April 20, 1997	Ice jams at the confluence of the Athabasca and Clearwater Rivers resulted in flooding within the Lower Town site of Fort McMurray, displacing both residents and businesses.
May 17, 2002	The House River Wildfire, ignited by lightning, engulfed 238,867 hectares, resulting in the residents of Conklin being temporarily displaced.
June 9, 2002	The Meyers Lake Wildfire engulfed 127, 453 hectares.
June 18, 2003	The Fort MacKay Wildfire engulfed 477 hectares.
July 17, 2004	The Cree Lake Wildfire engulfed 34,389 hectares.
June 16, 2006	The Louise River Wildfire engulfed 1,745 hectares.
June 20, 2006	The Embarras Wildfire engulfed 3,413 hectares.
June 29, 2006	The Little Horse Creek Wildfire engulfed 7,400 hectares.
June 1, 2007	The McKay River Wildfire engulfed 16,126 hectares.
July 17, 2007	The Old Fort Wildfire engulfed 63,000 hectares.
June 14, 2009	The Stoney Mountain Complex Wildfire, the result of lightning strikes, generated smoke and reduced visibility in many areas, including portions of Highway 63 which was temporarily closed. Gregoire Lake was also closed as water bombers used it as a water source.

July 15, 2010	Poor air quality advisory was issued by Alberta Health Services due to forest fires in Northern Alberta, British Columbia and Saskatchewan. Residents of Fort MacKay, Fort McMurray, and Fort Chipewyan with respiratory health problems were advised to take care and stay indoors.
May 15, 2011	Several wildfires were ignited due to human causes. Wildfire 4, 7, 8, 10 were eventually named the Bitumont Complex and an Area Command was created to deal with these fires. Fire 007 is the largest wildfire in Alberta's recorded history. Several camps had to relocate workers and CNRL, Kearl and Aurora had to close down operations for a period of time as the wildfire swept through their operations.

### Industrial Facility

The municipality's commercial and industrial activity has gone through many transition periods, starting with the fur trading industry, moving to an agricultural base, and on to the "Gateway to the North" - oil and gas servicing. In the 1950s, numerous chemical and petrochemical refineries were constructed north of the Urban Service Area of Fort McMurray and are still operating today. This strong economic base has attracted other heavy industries to locate in and around the Municipality leading to a higher rate of industrial facility related fires. However, fire safety records to date are positive.

DATE	EVENT
June 10, 2010	A fire broke out in the Mildred Lake Facility Plant 7-3 Diluent Recovery Unit (DRU) operated by Syncrude Canada Ltd. that took just over an hour to extinguish. Of the 5 workers transported to hospital with burn injuries, 2 were treated and released, while 3 were air lifted to an Edmonton hospital.

## **Landfill**

The Regional Municipality of Wood Buffalo operates five landfill sites. These sites are located on the south of Fort McMurray, Fort Chipewyan, and three modified sites located at Conklin, Janvier and Fort MacKay. The landfill site previously located at Mariana Lake has been closed.

Landfill fires can occur at both operating and closed landfills. In closed landfills fires generally occur due to spontaneous combustion. In operating landfills spontaneous combustion can occur in deep completed areas. The more common landfill fire is the result of “hot” loads of waste being deposited or lightning strikes on elevated surfaces. A hot load is one in which there are embers from a fire, often a domestic barbecue. Generally such fires are controlled by applying water and by using construction equipment located on site to smother the fire with soil. In the event of a fire, Regional Emergency Services is contacted.

Deep fires in operating or closed landfills represent an entirely different challenge. They generally pose no immediate catastrophic risk, but can lead to venting of hot and potentially toxic gases and the collapse of surfaces as material below is consumed. These fires can be controlled by the injection of water and/or inert gases. The extinguishing of such fires is done by specialty trained service providers and can take weeks or months.

The health risk from landfill fires generally arises from atmospheric discharge of gases, smoke and particulates that can have impacts on susceptible individuals.

## **Urban Fire**

An urban fire is an uncontrolled fire in a populated area beyond normal response capabilities.

Of the total population, approximately 46% live in single-family dwellings, 25% are residing in apartments, 10% are in townhouses, and 14% live in manufactured

homes. Fort McMurray has a relatively newer vintage of construction and a considerable amount of land, making widespread urban fires a rarity. In the event a large residential or industrial fire Regional Emergency Services has procedures in place to respond.

Fort McMurray still contains a number of structures that are questionable within a quality review. Neighborhood's with these structures are subject to urban decay and are undergoing a form of deterioration based on the nature of occupants, low (or non-existent) maintenance, and surrounding culture.

Modern codes, standards and safer building practices have produced better quality buildings using more non-combustible construction and installation of fire sprinkler protection. The Alberta Building Code is thought to be a leader and will set the standard for national and other provincial codes. As such, the risk and impact of major fires is somewhat less of a concern.

DATE	EVENT
April 17, 2007	A structure fire in the Edgewater Court Apartment Building resulted in the evacuation of 300 residents. The Municipality's EOC was activated to meet the needs of area residents.

**GEOLOGICAL/HYDROLOGICAL**

**Flood (surface)**

A flash flood is a localized flood of relatively great volume and short duration resulting from heavy rainfall or dam failure.

The Lower Town Site Area of Fort McMurray is subject to flooding when sudden snow melts, rain, and breaking ice jams cause water to dramatically overflow the banks of the Clearwater River.

Storm cells that affect the municipality tend to be limited in size, one-kilometer diameter being normal. Depending upon the intensity, duration, and frequency of

seasonal rainfall, several areas have been impacted by sudden heavy downpours. Results include flooded basements and underpasses, plugged catch basins, popped manhole covers, and impassable streets. During exceptionally wet years, land slippage has occurred.

### **Flood (waterway)**

*A waterway flood is “a rising or overflowing tributary or body of water that covers land that is normally dry. The 100-year flood usually defines flood-prone areas. A 100-year flood has a 1% chance of occurring in any given year. It is possible to have a 100 year flood each year.”*

The drainage area of the Athabasca River above the Urban Service Area of Fort McMurray is approximately 133,000 square kilometres and all of it lies south of the Urban Service Area of Fort McMurray. The Athabasca River is also tied to stream flow controlled by the Bennett Dam in British Columbia. Many creeks and streams feed both the Athabasca River and Clearwater River. These rivers have fluctuations of flow, height, color, and clarity throughout the year, along with constantly shifting sandbars.

Portions of the Urban Service Area of Fort McMurray situated along the Clearwater River, (Lower Town Site and Waterways Districts), have undergone periodic flooding since the area was first settled in the 1870's. The severest flooding occurs as a result of ice jams on the Athabasca River during the annual spring breakup. These ice jams typically form in the reach below the Clearwater River confluence, causing water and ice to back up the Clearwater channel. Serious ice jams can cause spectacular flooding that are exceptionally deep and stretches extensively upstream. In addition, the rise in water level may be remarkably rapid following the initial jam. Flooding can take place in a matter of one or two hours, thus allowing little time to implement emergency measures.

The spring snowmelt usually nears completion in most of the drainage basin before the river ice at the Urban Service Area of Fort McMurray has been weakened

by spring thaw. Because the ice is broken by the southern run-off instead of melting, it is called “River Breakup.” An important factor causing ice jams at or near Fort McMurray is the wide, fast shallow area of the Athabasca River, with multiple islands downstream of the Clearwater confluence. When the water and ice rushes toward that area, it loses a lot of momentum and, some years, fails to move the solid, stronger ice cover farther downstream.

The normal river elevation of the Clearwater River is 241.2 metres above sea level. Flood conditions develop when the water level rises to 243.3 metres (as seen in the chart below).

Previous floods occurred in:

DATE	WATER LEVELS
1881	250.0
1875	252.0
1885	249.0
1925	247.4
1928	248.5
1936	250.0
1962	246.2
1963	247.2
1974	246.7
1977	247.9
1979	246.3
1987	245.0
1988	243.1
1989	243.0
1993	243.3
1997	247.5
2003	242.1
2007	245.7
2008	243.5

Advance flood warnings are provided through the Government of Alberta Environment Water Sciences Branch, which monitors conditions year round. Through monitoring of seasonal snowfall and rainfall, information is issued to the public regarding current issues affecting stream flows in the province. Issues that may pertain to current advisories are high stream flow, spring runoff, river freeze up or breakup, as well as information that could affect river conditions in the province and in the municipality.

The following advisory and warning notifications are issued by Alberta Environment:

High Streamflow Advisory	Means that stream levels are rising or expected to rise rapidly and no major flooding is expected. Minor flooding in low-lying areas is possible. Anyone situated close to the streams affected (campers, fishermen, boaters and the general public) is advised to be cautious of the rising levels.
Flood Watch	Means that stream levels are rising and will approach or may exceed bank full. Flooding of areas adjacent to these streams may occur. Anyone situated close to the streams is advised to take appropriate precautionary measures
Flood Warning	Means that rising river levels will result in flooding of areas adjacent to the streams affected. Anyone situated close to the river should take appropriate measures to avoid flood damage.

Forecaster's comments, Near Real Time Hydro Meteorological Advisories and Warnings, and Water Supply and Weekly River reports are available on the Alberta Environment web site at: <http://environment.alberta.ca/1.html>.

Real time advisories and warnings providing information on high stream flows, floods and ice jams are available through the Alberta Environment website at: <http://environment.alberta.ca/forecasting/advisories/index.html>

Under the heading “Water Supply Outlook For Alberta”, Alberta Environment provides updated information summaries of current snowpack, precipitation, river flows, reservoir storage and soil moisture and their impacts on potential runoff in two areas: the plains and the mountains. Their website information link is: <http://environment.alberta.ca/forecasting/WaterSupply/index.html>

Alberta Environment maintains extensive Graphic Interface System (GIS) flood mapping for Alberta depicting flood risk information. The information is online at: <http://environment.alberta.ca/1291.html>.

The database can be queried (data-set limited to those with flood information available), by community. The data is displayed as a colour coded map showing projected flooded areas.

### **Landslide/Land subsidence**

A landslide is the rapid downward movement of a mass of rock, earth or artificial fill on a slope.

The municipality is not subject to landslides by definition, but rather land slippages that occur at a slower rate and tend to give warning signals (small surface cracks on roadways, sidewalks, and embankments) before they happen.

The municipality has a long history of land slippages along the river valley, freeways, ravines and creeks. Slippage can usually be attributed to heavy rainfall.

Combined with ground water, sources acting as a lubricant and the riverbank shifting through normal erosion, the area begins to slip away from the more stable landmass beside it. Slow steady rain for a number of days causes water to

percolate through layers of topsoil resulting in a situation of “super saturation” that acts as a lubricant causing instability.

The slide mass could be composed of materials that are sitting on a layer of bentonite, which is a plastic-type material. The slide zone becomes wet and lubricated accelerating the slide. The depth of these surfaces is usually related to the size of the slide.

Along the river valley erosion is a factor taken into consideration with the constant undercutting of the banks by strong currents. Flooding, although a cause of damage, is less a factor than the sudden subsidence of water level.

Through geotechnical engineering, potential problem areas are monitored regularly. Erosion protection is initiated along suspect or susceptible areas by measures that range from building retaining walls, maintaining roadways, rerouting trails and repositioning bridges through the park systems to a more stable ground.

## **PUBLIC DISORDER**

The municipality is considered to be a peaceful place. Numerous mass gatherings are held each year in celebration of sporting or cultural events and special holidays, such as Treaty Days and Canada Day. A number of groups in the past have also held strike posts due to real or imagined labour disputes. While most events are usually carried out without incident, some minor sporadic outbreaks of unruly demonstrations and public unrest have occurred.

### **Civil Disorder**

Typically this type of public disorder may occur at natural gathering places. Most violence, albeit infrequent, that has occurred has been aimed against property rather than people. Although no single condition or indicator precedes these events, the consumption of alcohol has been a prime factor.

DATE	EVENT
July 24, 2008	Greenpeace activists waged a protest after 500 ducks were found dead in a tailings pond on the Aurora Mine Site operated by Syncrude Canada Ltd. (April 2008).
September 15, 2009	25 Greenpeace activists entered the Muskeg River Mine Site operated by Shell Canada 82 kilometres north of Fort McMurray, and chained themselves to heavy equipment. Activists remained there 2 days, supplying live video footage to their website and unfurling banners. Activists left the property without charges being laid.
September 30, 2009	23 Greenpeace activists trespassed onto a mine site operated by Suncor Energy Ltd., traveling by boat on the Athabasca River. This event ended after police arrested 21 of the activists, many of whom were from European countries.

## Labour Disputes

The industrial revolution and mass production processes introduced in the 1920s gave rise to greater efficiencies in manufacturing and other industrial sectors. At the same time, many work forces formed coalitions or unions to represent the collective needs of workers or the workers of a specific industry segment. Over the years, many strikes have been organized in protest when perceived or real needs are not being met and contract negotiations break down. In the majority of cases, picket lines are set up and carried out without incident.

DATE	EVENT
Summer & Fall, 2007	During contract negotiations with various trade union groups, some impromptu picketing action occurred. Local RCMP monitored activities throughout the municipality. No serious incidents were reported during this period.
June 2011	Canadian postal workers were locked out due to unsuccessful contract negotiations. Workers picketed outside Canada post

DATE	EVENT
	offices. Local RCMP monitored activities throughout the municipality. No serious incidents were reported during this period.

## SEISMIC

### Earthquake

There is a large, stable, subterranean plate running through Edmonton. Although there have been minor earthquakes in other portions of the province; none have had a direct impact on the municipality. Somewhat like standing on a large piece of concrete near a roadway where heavy trucks are traveling, vibrations are felt but the vibrations do no damage. In February 2001, an earthquake in Seattle was recorded at the University of Alberta and may have caused, for example, chandeliers in large churches to sway.

In the event of a catastrophic earthquake in the lower mainland of British Columbia, The cities of Edmonton and Calgary have been designated as geographic supply depots to assist in the response and recovery efforts

## STRUCTURAL

### Structural Collapse

Structural collapse is an uncommon occurrence in the Regional Municipality of Wood Buffalo. It is most likely to occur during construction, demolition or renovations. During these times all of the normal structural components may not be in place, which makes the structure vulnerable to wind pressures, snow and rain loads. There have been problems where the bracing for wet concrete has not been sufficient to hold the product in place until it develops its own strength and thus the structure collapses.

Structural collapse is also possible due to design flaws or poor construction practices. However, many collapses within Alberta have occurred due to snow or water buildup on roofs but are infrequent in this area mainly due to the enforcement of building codes.

Structural collapse is also possible due to aging, poor maintenance, or weathering of structures. The most common concern in this area is likely rusting of steel beams and connections. Pieces of buildings fall off when steel connectors have deteriorated due to rust. Rusting is a major problem with concrete structures that rely on steel reinforcing bars, and pre- or post-tensioned cables to supply structural strength. Years of freeze/thaw cycles create cracks in the concrete that allow water to contact the steel beams or connectors. There have been many rehabilitation projects completed on bridges and parking structures for this reason. An example is noted below:

DATE	EVENT
April 24, 2007	A structural collapse of a large oil tank under construction on the CNRL Horizon Project site. Two workers were killed and left four injured.
March 11, 2011	An Order was delivered to the Penhorwood Condo Association creating the need to evacuate 168 units in 7 buildings. The Order was given by Superior Safety due to a Structural Engineering report that advised of structural deficiencies in all 7 buildings. Approximately 350 occupants were evacuated and the Penhorwood Taskforce was created to assist residents in those buildings.

## TERRORISM

Terrorism has been described as "*the calculated use of violence or the threat of violence to inculcate (to fix a person's mind by teaching them over and over again)*"

*fear; intended to coerce or to intimidate governments or societies in the pursuit of goals that are generally political, religious or ideological (US Army)."*

Since the deliberate air plane crashes in New York City, Washington D.C., and Pennsylvania on September 11, 2001, "terrorism" is an emerging hazard that is closely monitored by government officials at all levels.

There have been no known terrorist acts within the municipality.

(See also Dangerous Goods - *Biological Hazards.*)

## **UTILITY DISRUPTION**

### **Communication Failure**

A communication failure is the widespread breakdown or disruption of normal communication capabilities. This includes telephone outages, loss of local government radio facilities, or long term interruption of electronic broadcast services.

The municipality is served by many sophisticated methods of communication that have contingency plans, back-up systems, and recovery procedures in place.

### **Telephone Systems**

In the event of a power failure, telephone systems in the Regional Municipality of Wood Buffalo are powered by back-up battery systems and are capable of being operational for up to eight hours before needing recharging.

In the event of long term power disruption, TELUS has specialized vehicles with power generation capabilities to recharge batteries in each exchange to restore service.

TELUS has extensive recovery plans, specialized equipment, an Emergency Operations Centre, and rapid response teams in place. Recovery time for restoration of telephone systems would depend on the magnitude of the incident.

### **Private Broadcasters**

In the event of disaster, private broadcasters are very important outlets for public information. Most people will rely on of the 6 radio stations in the municipality for information.

There are four provincial television stations based out of Edmonton that become an important factor for news distribution once power has been restored. The local cable television provider (Shaw channel 10) is also key to assuring that local news and updates are communicated to those relying on cable connections rather than television aerials.

Most broadcasters have back-up power generation capability at their transmission sites and studios. In the event of a lightning strike at a transmission site, back-up transmitters can be utilized to restore at least a portion of the service.

### **Emergency Services Communications**

Communication systems within the 911, Police, Fire, and Ambulance systems are backed-up by emergency power generators. If a dispatch centre becomes inoperable, there are contingency plans and systems in place for transfer to alternate back-up sites.

Telecommunication companies and civic emergency broadcast systems have backup power sources and transmitters that would enable distribution of information.

The Regional Municipality of Wood Buffalo has back-up power for all emergency dispatch systems and alternate sites available in the event of a power failure and

the need for evacuation of dispatch centres. It is unlikely there would be long term communication failure.

### Heat/Natural Gas Disruption

ATCO gas services the entire municipality with the exception of Fort Chipewyan and Fort Fitzgerald. There are over 19,000 gas meters. A small number of homes especially in the Fort Chipewyan area utilize propane for heating. There have been a number of natural gas supply interruptions in the municipality over the years and are primarily caused by third party hits or damage to distribution lines. An example is listed on the following page.

DATE	EVENT
March 27, 2008	A work crew clipped a four inch natural gas line while excavating to repair a water main break. Manning Avenue between Hospital and Queen St was closed to traffic, pedestrians and businesses.
July 19, 2010	A 4 inch gas line was hit by a contractor doing road repair on Franklin Avenue; causing 4 businesses to be evacuated for a short period of time. The gas line was capped quickly and employees were returned to their businesses.
December 19, 2010	A natural gas line was struck on Sutherland Avenue and gas was shut off to MacDonald Island, River Park Glen (The Towers), Franklin Inn and Suites Hotel and 100 Richardson Street. It took several hours for the gas line to be capped and for gas to be turned on to the surrounding buildings.
October 27, 2010	Gas Line was struck at 104 Loutit Road, Timberlea. Nearby condos were evacuated for a short period of time. The gas line was quickly capped and residents returned to their homes.

The following are the yearly statistics that ATCO Gas has recorded on the number of gas lines hits within the municipality:

**YEAR 2008 Gas Line Hits:**

COMMUNITY	SERVICES	MAIN
Fort McMurray	19	10
Fort MacKay	1	2
Total	20	12
<b><i>Grand Total for 2008:</i></b>		<b><i>32</i></b>

**YEAR 2009 Gas Line Hits:**

COMMUNITY	SERVICES	MAIN
Fort McMurray	11	7
Anzac	1	1
Janvier	1	2
Total	13	10
<b><i>Grand Total for 2009:</i></b>		<b><i>23</i></b>

**YEAR 2010 Gas Line Hits:**

COMMUNITY	SERVICES	MAIN
Fort McMurray	8	20
Anzac	1	0
Janvier	0	1
Total	9	21
<b><i>Grand Total for 2010:</i></b>		<b><i>30</i></b>

## YEAR 2011 Gas Line Hits:

COMMUNITY	SERVICES	MAIN
Fort McMurray	11	5
Anzac	0	0
Janvier	0	1
Total	12	7
<b><i>Grand Total for 2010:</i></b>	<b>19</b>	

## Power Failure/Shortage

Power failure/shortage is defined as long term or widespread loss or reduction of electric power, or a shortage of petroleum products, which could have an adverse effect on the preservation of life and property.

ATCO Electric is the main supplier of power in the municipality. The Power Pool of Alberta runs a “black start” exercise every year in which all companies participate. A realistic restoration time would be 12-14 hours for total restoration.

DATE	EVENT
July 21, 2010	A major power outage south of Fort McMurray extending down Hwy 881 & Hwy 63 occurred due to a transmission problem. The power outage affected the area from Fort McMurray to 50 km South of town. Crews were dispatched and the issues was resolved within 20 minutes.

## Water Contamination

The Regional Municipality of Wood Buffalo has a water treatment plant located in Fort McMurray. The Regional Municipality of Wood Buffalo supplies Fort McMurray and 10 surrounding communities with a total population of 94, 000.

There are also water treatment plants located at Conklin, Janvier, Fort MacKay and Fort Chipewyan.

The Regional Municipality of Wood Buffalo Public Works Department conducts regular tests throughout the year. Sophisticated lab equipment is used to ensure that drinking water measures up to its credo “*better than it has to be.*” These tests are completed within many physical, chemical, and microbiological parameters. The municipality consistently tests water wells to ensure they are within safety limits.

With modern safeguards, monitoring, and higher levels of regulation, there is a decreasing risk of the municipality’s water supply becoming contaminated. However, in the rare case of it becoming contaminated a boil water order is put into effect until the appropriate levels are reached. An example is noted below:

DATE	EVENT
June, 2009	A “Boil Water” advisory was issued for the hamlet of Fort Chipewyan following a positive test for bacteria in a water sample. Subsequent samples all tested negative for bacteria results. Alberta Health Services lifted the advisory.

### **Water Supply Shortage**

The Athabasca River supplies the municipality and surrounding areas with a steady supply of water. Water levels throughout the year follow a natural ebb and flow; as the snow pack melts high in the mountains and with spring and early summer rain falls, the river reaches its usual high peak.

Providing that reservoirs are full or close to full, and that demand is not higher than normal, the municipality can last about two days without the treatment plants being operational. With demand management measures in place another day could be added.

## MITIGATION MEASURES

Over the past years Engineering has been involved in efforts to mitigate risk and damages rising from ice jam floods.

### Draper Road

- In 2010, about 2km of road grade, from Waterways to Market Garden, was elevated to 248.5m, which is the 1:40 year flood elevation (248.0m + 0.5m freeboard).

### Waterways

- Future construction of Saline Creek Parkway through Waterways, adjacent to Railway Avenue, will provide a 1:40 year flood berm (248.5m) for Waterways. Work is currently in design and construction is to be completed by 2013. The elevation of Railway Avenue at McCormick Street is about 250m (where the sewer lift station is) and it slopes downwards to about 246m at Park Street.

### Eco Industrial Park (Hwy 63N)

- 248.5m flood berm has been constructed around the industrial subdivision.

### Lower Townsite

- The East portion of Prairie Loop Blvd has been constructed to 248.5m, from the King Street turnaround to Riedel Street.
- Construction of the West portion of Prairie Loop Blvd, from Riedel Street to Main Street, will continue at an elevation of 248.5m. Work is to be completed by 2012. This will effectively complete the 1:40 year flood protection berm for the Lower Townsite.
- Flap gates are also being upgraded on all LTS Storm Sewer outfalls to prevent the potential backflow of water from the river into the Lower Townsite. This work is in progress and is to be completed by 2012.
- Pumping stations will be provided at key storm outfall locations to handle storm water surface runoff during and ice jam event. This work is in progress.

Notes:

Construction of the 1:40 (248.5m) year flood protection berm was selected over construction the 1:100 (250.5m) year flood protection berm because:

- Building to a 1:100 elevation at 250.5m would essentially cut off the lower townsite from the Snye and Clearwater river.
- The additional 2m in elevation would make it difficult to establish functional road connections from the loop road into the existing lower townsite road system, some of which are at 247m.
- The cost of the work would escalate.
- Flood protection berms, built to higher elevations, do not provide an absolute guarantee against damages occurring from ice jam flooding.
- The 1:40 year flood berm, at 248.5m, will mitigate against damages occurring from the more frequent flood occurrences, while still allowing the community to enjoy the many benefits of the river system during the remaining 97% of the time.
- Our Land Use Bylaw still requires that new residential construction is built above the 250m elevation, irrespective of flood protection berms.

## CONCLUSION

Only the prime hazards were listed, but secondary hazards or events can occur as a result of, or in concurrence with a major event. A high windstorm or tornado is a major hazard. Secondary events such as downed power lines, surface flooding, traffic jams, and multiple casualty accidents can occur.

Secondary events can cause as much disruption as a major event. Sometimes the effects are immediate; while at other times problems may arise later. The deterioration of bridge footings during a flood or the weakening of tree limbs from heavy snow may not be immediately apparent.

The Regional Municipality of Wood Buffalo, through the Municipal Emergency Plan and the Hazard, Risk and Vulnerabilities Assessment, endeavors to protect people, property and the environment. All the hazards addressed in this assessment have been recognized in the past or are of a recent emerging nature. Changes in conditions in the municipality that significantly affect vulnerability will continue to be monitored.